

**WHAT IS CLAIMED IS:**

1. A semiconductor device comprising:  
a first insulating film on a silicon substrate; and  
5 a second insulating film on said first insulating film;  
wherein said first insulating film is a silicon oxide film  
having a film thickness of 1 nm or less and a suboxide content  
of 30% or less; and  
said second insulating film is a high dielectric constant  
10 insulating film.
2. The semiconductor device according to claim 1, wherein  
said high dielectric constant insulating film is a metal oxide  
film or a metal silicate film.  
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3. The semiconductor device according to claim 2, wherein  
said metal oxide film is an oxide film of at least one metal  
selected from a group consisting of hafnium, zirconium,  
lanthanum and yttrium.  
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4. The semiconductor device according to claim 2, wherein  
said metal silicate film is a silicate film of at least one  
metal selected from a group consisting of hafnium, zirconium,  
lanthanum, yttrium and aluminum.  
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5. The semiconductor device according to claim 4, wherein  
said metal silicate film contains nitrogen.
6. A semiconductor device comprising:  
30 a first insulating film on a silicon substrate; and  
a second insulating film on said first insulating film;  
wherein said first insulating film is a silicon oxynitride

film having a film thickness of 1 nm or less and a suboxide content of 30% or less; and

    said second insulating film is a high dielectric constant insulating film.

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7. The semiconductor device according to claim 6, wherein said high dielectric constant insulating film is a metal oxide film or a metal silicate film.

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8. The semiconductor device according to claim 7, wherein said metal oxide film is an oxide film of at least one metal selected from a group consisting of hafnium, zirconium, lanthanum and yttrium.

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9. The semiconductor device according to claim 7, wherein said metal silicate film is a silicate film of at least one metal selected from a group consisting of hafnium, zirconium, lanthanum, yttrium and aluminum.

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10. The semiconductor device according to claim 9, wherein said metal silicate film contains nitrogen.

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11. A semiconductor device comprising:  
    a first insulating film on a silicon substrate; and  
    a second insulating film on said first insulating film;  
wherein said first insulating film is a silicon nitride film having a film thickness of 1 nm or less and an oxygen content of less than 0.1 atom%; and

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    said second insulating film is a high dielectric constant insulating film.

12. A method for manufacturing a semiconductor device,

comprising the steps of:

treating a surface of a silicon substrate with a non-oxidizing gas under reduced pressure;

5 forming a first insulating film on said silicon substrate while maintaining said reduced pressure;

forming a metal oxide film on said first insulating film using an oxygen containing material, said metal oxide film being a second insulating film; and

10 heat treating said metal oxide film under an atmosphere of an oxidizing gas.

13. A method for manufacturing a semiconductor device, comprising the steps of:

treating a surface of a silicon substrate with a non-oxidizing gas under reduced pressure;

15 forming a first insulating film on said silicon substrate while maintaining said reduced pressure;

forming a metal silicate film on said first insulating film using an oxygen containing material, said metal silicate film being a second insulating film; and

20 heat treating said metal silicate film under an atmosphere of an oxidizing gas.

14. The method for manufacturing a semiconductor device according to claim 13, further comprising a step of:

after said heat treatment, performing a treatment for increasing a nitrogen concentration of a surface of said second insulating film.

30 15. The method for manufacturing a semiconductor device according to claim 14, wherein said treatment for increasing said nitrogen concentration is a heat treatment under an

atmosphere of ammonia gas.

16. The method for manufacturing a semiconductor device according to claim 14, wherein said treatment for increasing 5 said nitrogen concentration is a plasma treatment using nitrogen gas.

17. The method for manufacturing a semiconductor device according to claim 13, wherein said first insulating film is a 10 film selected from a group consisting of a silicon oxide film, a silicon oxynitride film and a silicon nitride film.

18. The method for manufacturing a semiconductor device according to claim 13, wherein:

15        said step of treating said surface of said silicon substrate with said non-oxidizing gas is performed at a temperature between 25 °C and 600 °C; and  
              said non-oxidizing gas is a fluorine containing gas.

20        19. The method as claimed in claim 13, wherein a partial pressure of said non-oxidizing gas is 100 Pa or less.

20. The method for manufacturing a semiconductor device according to claim 13, wherein:

25        said non-oxidizing gas is a fluorine containing gas; and  
              said fluorine containing gas is at least one selected from a group consisting of HF, ClF<sub>3</sub>, F<sub>2</sub> and NF<sub>3</sub>.

30        21. The method for manufacturing a semiconductor device according to claim 13, wherein said oxidizing gas is oxygen gas.

22. The method for manufacturing a semiconductor device

according to claim 21, wherein said oxygen gas contains ozone or oxygen radicals.

23. The method for manufacturing a semiconductor device  
5 according to claim 13, wherein said heat treatment is performed  
at a temperature between 100 °C and 400 °C.